Sheldon Leemon

INSTEDIT

Microsoft BASIC version

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INSTEDIT

(Microsoft BASIC version)

by

Sheldon Leemon

Program and Manual Contents © 1982   Sheldon Leemon

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```
IMPORTANT!


DUPLICATE
  THIS
DISKETTE
 BEFORE
 USING
  THIS
PROGRAM!
```
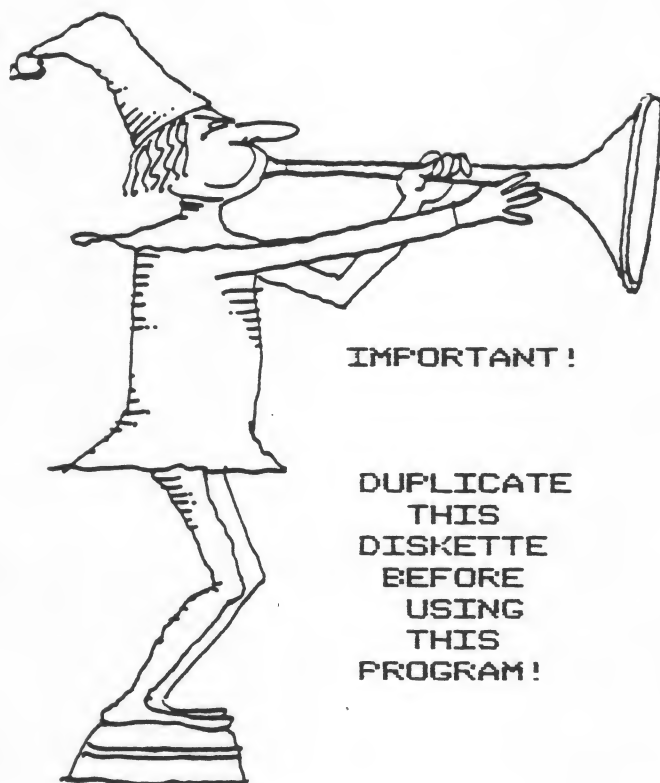
This APX diskette is unnotched to protect the software against
accidental erasure. However, this protection also prevents a program
from storing information on the diskette. The program you've
purchased involves storing information. Therefore, before you can use
the program, you must duplicate the contents of the diskette onto a
notched diskette that doesn't have a write-protect tab covering the
notch.

To duplicate the diskette, call the Disk Operating System (DOS) menu
and select option J, Duplicate Disk. You can use this option with a
single disk drive by manually swapping source (the APX diskette) and
destination (a notched diskette) until the duplication process is
complete. You can also use this option with multiple disk drive
systems by inserting source and destination diskettes in two separate
drives and letting the duplication process proceed automatically.
(Note. This option copies sector by sector. Therefore, when the
duplication is complete, any files previously stored on the
destination diskette will have been destroyed.)

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INTRODUCTION

OVERVIEW

INSTEDIT is a character set editor that simultaneously displays the character you're editing in all six character modes (the three supported by BASIC and the other three supported only by the hardware). As you use a Joystick Controller to edit the character in an eight-by-eight grid, you see immediately how each change affects the character in every mode. When you want to experiment with combining characters, merging them to create larger objects, you can use INSTEDIT's memo pad mode, which lets you work in the lower half of the screen in any of the six character modes. It can even help you create objects for use with the ATARI computer's system of player missile graphics.

In addition to point-by-point character editing, INSTEDIT's menu options let you change the whole character at once. You may change it to appear as it does in the ROM character set, erase it, restore its original shape, invert the colors of the letter and background, copy the form of another letter, create a mirror image, rotate it ninety degrees at a time, and shift its position within the matrix. Other options let you save a character set for further work later and load in a stored character set. Once you've finished editing a set, INSTEDIT will store all or part of your character data to diskette in the form of BASIC DATA statements, or assembler source code using the .BYTE directive, or even an entire BASIC subroutine for incorporating your new character set into an existing program.

REQUIRED ACCESSORIES

40K RAM
ATARI Microsoft BASIC (CX8126)
ATARI 810 Disk Drive
One ATARI Joystick Controller

CONTACTING THE AUTHOR

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Oak Park, Michigan 48237

GETTING STARTED

LOADING INSTEDIT INTO COMPUTER MEMORY

1. Remove any cartridge from the cartridge slot of your computer.

2. Plug your Joystick Controller into the first (the leftmost) controller jack at the front of your computer console.

3. Turn on your disk drive.

4. When the BUSY light goes out, open the disk drive door and insert the Microsoft BASIC diskette with the label in the lower right-hand corner nearest to you.

5. Turn on your computer and your TV set. Microsoft BASIC will automatically load into computer memory. The free memory message, copyright notice, and right arrow cursor will display on your TV screen.

6. Remove the Microsoft BASIC diskette and insert the INSTEDIT diskette. Type RUN "D:INSTEDIT" and press the RETURN key.

7. After a few seconds of setup time, INSTEDIT's five-part screen, described in the next section, will display.

USING INSTEDIT

INTRODUCTION

Why create custom character sets?

Creating custom character sets can serve a number of purposes. For example, you might want a custom character set for your computer programs for the same reason you'd want a changeable typehead on a typewriter: you may need special math symbols, chemistry symbols, foreign language alphabets, or a special typeface to set the mood for a particular program.

On a more sophisticated level, you may want to develop special graphics characters as a substitute for the plot-and-draw method for producing high-resolution graphics. By positioning several characters together, you can create a high-res picture as easily as you can print a character string. You can achieve the same resolution with custom mode 0 characters as you can with mode 8 drawing. The difference is that by using specially designed characters, you avoid the high memory usage required for mode 8, as well as the tedious and slow plotting of each point and line. You can put the finished drawing on the screen much more quickly, achieving smooth animation in BASIC just by printing strings of characters in succession, each representing a figure in a different position.

Using machine-language subroutines, you can extend your work into developing professional-quality, fast-action arcade games with full color, high-res animation. Using custom character sets in this way introduces a new level of graphics power and flexibility. If you're familiar with the ATARI computer's player missile graphics system, you can even use INSTEDIT to design players.

How INSTEDIT works

When you press a key on your ATARI computer's keyboard, one of 128 different characters appears on your TV screen. The shape of each character is determined by a collection of data stored in computer memory. INSTEDIT lets you change this data, and thus the shape of the characters, as easily as drawing a picture.

The procedure is as follows. You use the computer's keyboard to select the character you want to edit. A large-scale model of this character then displays in an eight-by-eight grid. Using a joystick, you move a cursor to any of the 64 squares and modify the character's shape--add or remove color by pressing the red trigger button (if color is already present, pressing the button erases it; if color is absent, pressing the button adds color). As you change the model character, these changes appear in the samples of the character, which are displayed in each character mode. Additional editing features let you experiment further with your characters. You can save your finished set on diskette or cassette for future editing, or you can incorporate it into a BASIC or assembly language program.

INSTEDIT'S MENU

INSTEDIT's display screen is divided into five areas. It looks roughly as follows:

```
     (1)                 (2)                 (3)
  ----------          ----------          ----------
 |A ATARI   |        |>>SELECT->|        |-↑← SHIFT|
 |B BLANK   |        |          |        |          |
 |C COPY    |        |          |        |E EDIT    |
 |I INVERT  |        |(C) 1981  |        |S SAVE    |
 |M MIRROR  |        |by S.     |        |L LOAD    |
 |R RESTORE |        |Leemon    |        |W WRITE   |
 |T TWIST   |        |          |        |???   ???|
 |          |        |          |        |???   ???|
 |          |        |    .     |        |???   ???|
  ----------          ----------          ----------

                         (4)
  ----------------------------------------------------
 | !"#$%&'()*+,-./0123456789:;<=>?                    |
 |@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_                     |
 |<graphics characters                    >           |
 | abcdefghijklmnopqrstuvwxyz<graphics>               |
  ----------------------------------------------------

                         (5)
  ----------------------------------------------------
 |                                                    |
 |          <model character in                       |
 |           five character modes>                    |
 |                                                    |
  ----------------------------------------------------
```

Figure 1   INSTEDIT's Display Screen

(1) Submenu of advanced editing features, usable with the main menu's EDIT option.

(2) Frame for the 8-x-8 character grid. Initially, this frame contains the program title. Prompts also display in this area.

(3) Main menu of program options. Underneath the options are three sample rows of the model character (?) in mode 0, in both normal and inverse video.

(4) Mode 0 display of the entire character set (in Internal Character Set order).

(5) The model character (?) displayed in the other five character modes, in this order:

    (1) Instruction Register (IR) Mode 3
    (2) IR Mode 4
    (3) IR Mode 6 (BASIC GRAPHICS Mode 1)

(4) IR Mode 5

(5) IR Mode 7 (BASIC GRAPHICS Mode 2)

IR Modes 3, 4, and 5 are character modes supported by the hardware, but not by ATARI BASIC. The appendix discusses these hardware modes, sometimes referred to in ATARI manuals as ANTIC modes.

MENU SELECTIONS

You select a menu function by pressing the key matching the first letter of the function. The functions are as follows.

E EDIT

When you press the letter "E", the prompt, WHICH CHARACTER TO EDIT?, displays in the center frame. Type in your desired character using the LOWR or CTRL key, as appropriate, to edit a lowercase or control character. If your desired character is an editing symbol, such as one of the arrows, do not press the ESC key before pressing the combination of keys used to carry out the edit function.

After you select a character to edit, your choice displays at the top of the main menu and in each of the screen locations initially occupied by the question mark. In addition, a large-scale model displays in the center frame, along with a yellow cursor.

Use your joystick to move the cursor within the frame to edit the character. Press the red trigger button to change the square--to color an empty square, or erase a colored square. Each of the sample characters reflects your changes as soon as they occur; however, the menu and prompt lettering remain in the standard character set.

While in EDIT mode, you can also use the submenu options of ATARI, BLANK, COPY, INVERT, MIRROR, RESTORE, and TWIST, explained below. After you finish editing a character, you can go to another by pressing the "E" again, or you can select the SAVE, LOAD, or WRITE function.

The Submenu functions are as follows. Select a function by pressing the matching letter.

A ATARI

Restores the character being edited to its normal (ROM set) appearance.

B BLANK

Clears the whole character currently being edited, giving you a clean background on which to design a new character.

C COPY

Replaces the character currently being edited with any other character. After
pressing "C", the prompt, WHICH CHARACTER TO COPY?, displays in the center
frame. Type in your desired character. The current character then becomes a
duplicate of that character.

I INVERT

Reverses the colors of the current pattern. All colored squares change to
background and vice versa.

M MIRROR

Changes the character to the mirror image of its present shape. If the
character is symmetrical, no change is apparent.

R RESTORE

Restores the original character as it appeared the last time you pressed "E"
for EDIT. Any intermediate changes are lost.

T TWIST

Rotates the entire character on its axis ninety degrees clockwise each time you
press "T".

←↑↓→ SHIFT

Depending on which arrow key you press, shifts the whole character up a line,
down a line, one square to the left, or one square to the right. You can repeat
the function by holding down an arrow key.

S SAVE

Use this function to store the complete current character set as a data file on
diskette. You can then continue editing the set later, or you can incorporate it
into another program.

When you press "S", the prompt asks you to name the data file. Enter a file name and
press the RETURN key. Don't include an extender; the program auomatically adds the
extender ".SET" to your file name, to identify it as a character set data file.

When the program finishes storing the character set to diskette, the message SAVE
COMPLETE displays in the center frame. If an error occurs so that the program can't
complete saving your character set, an error message will display in the center
frame, after which the original prompt redisplays. By consulting your BASIC manual,
you should be able to determine from the numbered I/O error message whether the
diskette you're using contains no free sectors, is damaged, or contains a
write-protected file of the same name as the one you're trying to save.

To cancel a SAVE, press the RETURN key instead of entering a file name. The message CANCEL SAVE displays in the center frame.

Although editing character sets might look like drawing, what is really occurring is plain old data manipulation. As is true any time you work with data, saving your revisions every so often is good practice. This protects you from calamities such as your cat pulling out the cord from the wall outlet, thereby wiping out an afternoon's worth of work. How often you save you work depends on how much of it you're willing to lose!

L LOAD

Use this function to load a previously saved set from diskette. First, the program asks you to type the name of the file to be loaded and then press the RETURN key. Enter only the name you saved; the program automatically appends the extender ".SET" to your file name. To recall the name of a file, enter an asterisk (*)--the first ten data files in the directory will display at the top of the Submenu area. Display additional file names by pressing the asterisk again. Like the Save function, you can cancel a Load by pressing the RETURN key without first entering a file name.

The message LOAD COMPLETE displays after a successful load. A numbered error message will appear if the program can't load the file, and the original prompt then redisplays. In such a case, check the error codes in your BASIC manual to determine the cause of the error. Avoid using any of the I/O commands (Save, Load, or Write) without first making sure your diskette is inserted and the disk drive door is closed. Otherwise, the drive will keep trying to carry out the program's instructions until a timeout occurs. This activity could continue for a couple of minutes, during which time you might think the program has crashed. If one of these situations occurs, just be patient until the timeout occurs and then correct the problem and continue.

W WRITE

Use this function to store a file on diskette in such a form that you can incorporate it into an existing program. To provide flexible alternatives for fullest use of your newly defined characters, INSTEDIT can write your character set data in statements you can make part of either BASIC or assembly language programs. In addition, Note 1 in the "Applications Notes" section explains an easy way to have a BASIC program read in a new character set from a data file, using the LOADSET.LST subroutine included on the INSTEDIT diskette.

When you press "W", a submenu displays the WRITE options: (1) DATA and (2) .BYTE. Explanations of these options follow.

(1) DATA

Use this option to save any character or group of characters to diskette in the form of numbered BASIC DATA statements. This option is useful in cases where you have only a couple of characters to be altered and don't want to read in the whole set using the LOADSET.LST file. It's also suitable for occasions when you want to distribute printed listings of your program. The DATA option is also ideal for using the characters created with INSTEDIT for player missile graphics. Because both players and text characters are eight bits wide, character data can be POKEd into player memory without alteration, and it will produce a player the same shape as the character.

After selecting the DATA option, a prompt requests the name of the data file under which the program will save your character set data. The program automatically adds the extender .DAT to your file name so that you'll recognize it as a DATA statement file. Type in your desired file name and press the RETURN key.

Next, the program prompts you to enter the starting line number for the statements and then the increment between line numbers. If, for example, you enter 1000 as your starting line number and 10 as your increment value, the resulting file will contain statements in the form:

```
1000 DATA &00,&00,&00,....
1010 DATA &A4,&46,&57,...
```

The program then asks users to press the key of the first letter to be saved to the file and the number of consecutive letters starting with that letter that are to be written to the file. Consecutive letters mean the order of the Internal Character Set (corresponding to the order of the complete character set in the middle area of the INSTEDIT display), not ATASCII order. A listing of consecutive order is in Appendix K of the Microsoft BASIC Instruction Manual. Hence, if you want to write a file with data for the letters A through Z, you first press "A" and then "26" to specify the number of characters to be saved. To write a file containing the whole set, you first press the SPACE BAR (which is the first character in the Internal Character Set), and then type 128 for the number of characters.

After you enter this information, the prompt HIT RETURN WHEN READY displays. You can now insert the proper diskette. When you press the RETURN key, the program will write the selected characters to the file in LIST format. The message WRITE DONE displays after the program completes the write activity. The HIT RETURN WHEN READY prompt redisplays if the program can't complete the activity. You can cancel the option by pressing the ESC key instead of the RETURN key.

The program stores character data in groups of 24 bytes (three characters) per program line. You can merge the completed data file with another BASIC file by loading the latter and then using the MERGE command.

(2) .BYTE

Use this option to produce data files suitable for immediate integration into assembly language source code. The option is similar to the DATA option. However, instead of writing the data file in the form of numbered BASIC DATA statements, this option produces numbered lines beginning with the .BYTE directive and followed by the data in hexidecimal

form. The output produced takes this form:

        1000 .BYTE $00, $49, $2F, $FC, $4B, $0B, $BE, $C7

You can enter the data file directly to the Editor using the Command ENTER #D:filespec.
Diskette files produced by this option have the extender .BYT . The .BYTE option writes
only one character's (eight bytes) worth of data per line.

MEMO PAD MODE--OPTION key

Press the OPTION key to enter and exit Memo Pad mode. This mode, like the ATARI memo pad,
lets you print any combination of characters just to see how they look. INSTEDIT,
however, doesn't limit you to graphics mode 0. You can choose any of the six character
modes in which to print combinations of characters.

After pressing the OPTION key, a prompt tells you to type a number between 0 and 7. Type
in 0, 1, or 2 to set up the bottom half of the screen in the BASIC graphics mode of the
corresponding number. Type in 3, 4, or 5 to set the Memo Pad to the corresponding IR
mode. Type 6 to use the Memo Pad but not clear the bottom of the screen, which usually
occurs when you choose a new mode. This last choice lets you go back and forth from EDIT
mode to Memo Pad without changing the contents of the Memo Pad. Type a 7 to restore the
lower screen to its initial configuration.

After you choose a mode for the memo pad, the program sets the lower half of the screen
to that mode. The cursor, which is visible only in BASIC mode 0 and IR mode 3, is
positioned in the upper right-hand corner of the pad. You can then print characters and
set up various combinations of edited characters to see their interconnection. You can
use a group of characters to form one large picture, or you can use several characters
stacked vertically to create a tall player.

To return to EDIT mode, press the OPTION key again. The lower half of the screen remains
the same while you edit characters, until you press the OPTION key again. Once you press
OPTION, you clear the lower screen by choosing a mode, or you exit by pressing the "7",
which reinitializes the screen.

APPLICATION NOTES

(1) The file provided under the name LOADSET.LST is a subroutine that can be MERGEd into your Microsoft BASIC programs, and which will read one of your saved character sets from the disk, directly into the area of memory set aside by the OPTION CHR1 command. To used the subroutine, MERGE it into your program, and substitute the name of your set for the example name provided (D:COMPUTER.SET). If the numbers used are incompatible with your program, use the RENumber command to change them. Now your program will load in your new character set instantly!

One thing that you should remember about the OPTION CHR1 command is that it saves the area behind the display data for character data. If you change graphics modes, to a mode requiring more memory, you will find that your data area is now display area, and no longer safe! The only way to make sure that the area will remain safe is to give the OPTION CHR1 command after calling the most memory-intensive mode used by your program.

(2) INSTEDIT allows you to you to view edited characters as they appear in IR modes 3,4, and 5. Although a complete treatment of the Display List is way beyond the scope of this manual, a couple of short BASIC routines are included below which will set up a full screen of each of the IR modes. These will allow you to experiment with these modes, and to use the Script set included with INSTEDIT, which requires the use of IR Mode 3. For further information on these modes, consult the Appendix, and the Selected Bibliography.

In each case, start with:

```
10 GRAPHICS 0:DL=PEEK(560)+256*PEEK 561
```

For IR Mode 3:

```
20 POKE DL+3,67:FOR I=6 TO 23:POKE DL+1,3:NEXT I:POKE
DL+24,PEEK(560):POKE DL+25,PEEK(561):POKE DL+26,65
```

For IR Mode 4:

```
20 POKE DL+3,68:FOR I=6 TO 28:POKE DL+I,4:NEXT I
```

For IR Mode 5:

```
20 POKE DL+3,69:FOR I=6 TO 16:POKE DL+I,5:NEXT I:POKE
DL+17,PEEK(560):POKE DL+18,PEEK(561):POKE DL+19,65
```

(3) One way of getting more colors on a Mode 0 or Mode 8 screen is by using color artifacts. You will notice that if you put dots only in odd or even columns (i.e., without ever putting two dots side-by-side), you will generate a couple of new colors. While it is recommended that you avoid this for text characters, it might be useful for graphics characters.

(4) One promising application that seems to be a natural would be to design a series of characters depicting the face cards of a deck of playing cards. Although I haven't had the time to try my hand, I would be interested in hearing from anyone who designs such a set.

(5) Using the data generated by Write, Option 2, it is fairly easy to plot out Mode 0 characters on a Graphics Mode 8 screen, so that text and map-plot graphics can appear on the same horizontal line. As an example, use Option 2 to generate a file with DATA

statements for 26 letters. Type NEW, ENTER the data, then type in the following program:

```
10 GRAPHICS 8:DM=PEEK(560)+256*(PEEK(561)+4
:DM=PEEK(DM)+256*PEEK(DM+1):OFF=1680

20 FOR I=1 TO 25:FOR J=0 TO 7:READ A:POKE DM+OFF+J*40+I,A
:NEXT J:NEXT I

30 GOTO 30
```

By varying the offset constant (OFF), you can position these characters around the screen.

(6) As mentioned in the Menu section, the data generated by Write Option 1 or 2 can be used directly to define Players for Player-Missile Graphics. This data can be POKEd directly into the area reserved for Player data. Just remember that data from more than one character will stack up vertically, one byte per horizontal line. Also, to save space and time, remove any 0 data that precedes or follows the actual player shape.

You may want to keep in mind that Player-Missile Graphics offers three width options for each Player. Therefore, you may make use of INSTEDIT'S display of the double-wide characters of Graphics Modes 1 and 2, as well as the large center display (which itself is 1 maximum-width player) to visualize the appearance of the Players you design in varying widths.

TROUBLESHOOTING

(1) Normally, about the only type of problems encountered will be related to Input/Output. Examples of such errors are use of illegal disk file names, trying to write to locked files, trying to read non-existent files, or trying to read an improperly-positioned tape. INSTEDIT returns a numbered error message when a load or save fails, and returns to the last prompt. This gives you an opportunity to check your cassette or disk, make sure everything is set up right, and try again, or cancel.

(2) At most times the user is protected against accidental use of the editing keys in a way which would interfere with the screen display. However, full editing functions are restored when the user is requested to input information longer than one character, such as a file name. During these times, accidental use of an editing function such as the line delete may disrupt the display. If this occurs, complete the function in process. Then, hit the OPTION key to enter Memo Pad mode. Select option 7, Exit. This will restore the screen to its original configuration.

(3) While the BREAK key has been disabled, the SYSTEM RESET key still works. If you accidentally press the SYSTEM RESET key, you can restart the program by typing RUN. If you do, however, you'll lose all previous character data. To save your data, before typing RUN type GOTO 2000. This statment lets you enter the Save routine without clearing character data. When the "SAVE COMPLETE" message appears, you may press the SYSTEM RESET key and RUN the program.

APPENDIX

ATARI'S "HIDDEN" CHARACTER MODES

The reason that Atari computers are able to offer such a large number of Graphics modes is that they use a separate graphics microprocessor to handle the screen display. This chip receives instructions on how to display data from a simple program contained in RAM. If you are using BASIC, the computer writes this program every time you give a GRAPHICS command. But since this program is in RAM, it is possible for the user to alter it with the POKE command. Several articles have appeared in magazines giving instructions on how to change this program, called the Display List, so that many different graphics modes can appear on the screen at the same time. A step-by-step plan for creating these mixed Display Lists appears in Appendix B of the Atari Hardware Manual (available from Atari Customer Service). The key step involves changing the DISPLAY instruction. This instruction consists of a number from 2 to 15. Each time it appears, it orders the graphics chip to display one line of a particular mode. For example, POKEing in a 2 orders the chip to display one line of Mode 0, a 6 orders up one line of Mode 1, a 7 one line of Mode 2, etc. Notice how the numbers 3,4,5, were skipped? These are the DISPLAY instructions for the "hidden" character modes.

When I first tried POKEing those DISPLAY instructions into a Mode 0 Display List, I came up with some pretty funny-looking characters that I really didn't understand. In order to find out the purpose behind these modes, which are not supported by BASIC, I had to turn to the Hardware Manual. It outlines, in fairly technical terms, some hardware features which are not explained by the reference material supplied with the computer.

To help in the explanation of these modes, I have listed two short programs. The first of these (Listing 1) demonstrates what is referred to in the Hardware Manual as Instruction Register (IR) Mode 3. In Line 10, I POKE a 3 into bytes 19-26 of the Display List, producing a screen which is 1/2 BASIC Graphics Mode 0 and 1/2 IR Mode 3. Next, the whole character set is printed in both modes (Line 30). Finally, a few adjacent characters are printed in both modes for the purpose of comparison (Lines 40-45).

When this program is run, the IR Mode 3 characters at the bottom of the screen do not appear to be much different than the mode 0 characters at the top. On more careful examination, however, some differences can be detected. First, there is more room between the rows of characters in IR Mode 3. This is seen in the fact that while the four diagonal graphics characters in the middle of the screen form a diamond shape in Mode 0, there is a gap between the top and bottom triangles in IR Mode 3. Also, the cursor is taller in that mode. The second difference occurs only in the last 32 characters of the IR Mode 3 set. These characters appear to be shifted, so that the top part of the character has been cut off and moved below the bottom of the character.

According to the Hardware Manual, there is a simple reason for these differences. By creating a longer block for these characters, and having some appear at the top of the block and some at the bottom, the user can create a custom character set with true descenders for lower case letters like "y" and "p". In order to explain exactly how this mode accommodates these changes, however, we must first review the method by which the computer determines the shape of a character.

When the computer wants to display screen data as a graphics character, it must look up

the shape of the character in a table stored in memory. To find this table, it looks up its location in a pointer held in memory location 756 (decimal). Normally, this pointer holds the number 224, because the ROM character data is stored starting at page 224 (this is equal to memory location 57344, decimal). If you are using a custom character set, such as those created with INSTEDIT, the pointer will hold the beginning location of that set of data in RAM. Each character is represented by 8 bytes of data. As each of these bytes is composed of 8 binary digits (or bits), we can picture this data in the form of an 8x8 grid. Figure 1 shows how the data for the upper and lower case letter "L" is interpreted into the character seen on screen. In this drawing, each horizontal row represents one byte (the numeric value of which is given on the left). Each vertical column represents a bit place. A darkened square represents a "1" state in the corresponding bit location (the bit values, which equal the successive powers of 2 from 2 to the 0 (1) to 2 to the 7th (128) are shown at the top of each column). So, for example, no squares are darkened in the top row of Figure 1(a), and therefore the first byte has a value of 0. In the second through sixth rows, where bits 5 and 6 are darkened, the byte value is 96 (64+32).

In IR Mode 3, however, these same characters are set up in a 10x8 grid. Two blank scan lines are inserted below each of the first 96 characters (see Figure 2(a)). The last 32 characters, which include the lower-case alphabet, receive special handling. When one of these characters is set up in the grid, the first two bytes are shifted down to the bottom two lines (see Figure 2(b)). This shift of the last 32 characters means that they use the bottom 8 lines of the grid, while the other characters use the top 8 lines, thus enabling the use of the bottom two lines for descenders. A practical example of the use of this mode can be seen in the SCRIPT set, which is included with INSTEDIT. You will note that while the mode accommodates the characters with descenders very well, the tall characters such as the lower-case "b" and "d" must be transferred to the spot reserved for their respective Control-characters, so that they will not be shifted down, and can attain their full height.

The other two hardware-supported character modes are demonstrated by the program in Listing 2. Lines 10-20 of that program set up the screen half in IR Mode 4, and half in IR Mode 5. Line 30 prints the full character set in each mode. Line 40 changes the background color for better visibility. The rest of the program enables the use of the console switches to change the color and luminescence value of each register. The SELECT button determines the register, START changes the color of that register, and OPTION the brightness.

These two modes are 4-color character modes. The only difference between these two modes is that IR Mode 5 characters are twice as high as those of IR Mode 4. Unlike BASIC modes 1 and 2, these IR Modes can mix colors within a particular character.

Upon looking at the standard character set in these two modes, it will be apparent that these modes are not really suitable for text characters. When used with custom-designed graphics character sets, however, four-color graphics with the same resolution as BASIC Graphics mode 7 can be created, and placed on the screen just by PRINTing a string of characters.

To enable this colorful display, the computer divides each byte of character display data into 4 groups of 2 bits each. These groups determine the color of the four pixels per row. The four possible combinations produce the following colors:

Neither bit set--displays the background color (register 4)

Right bit set-- displays the color in register 0

Left bit set--displays the color in register 1

Both set--displays the color in register 2 for normal video,and the color in register 3 for inverse video characters

Because two bits are needed to determine the color of each pixel, the horizontal resolution is cut in half. Figure 3 shows how this affects letters in the existing character set. You should be able to verify this effect by changing the color registers in the demonstration program by using the console switches as explained above.
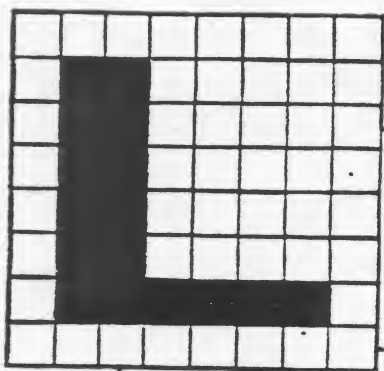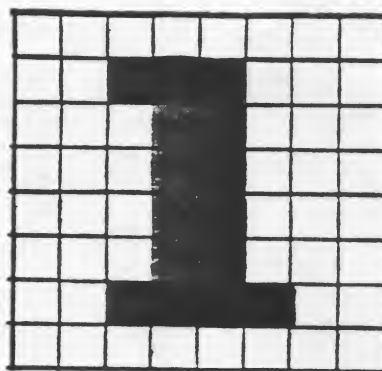
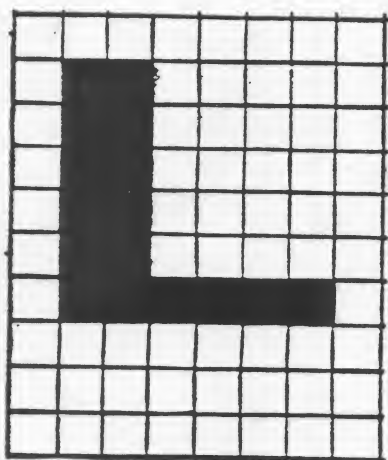(a)   (b)
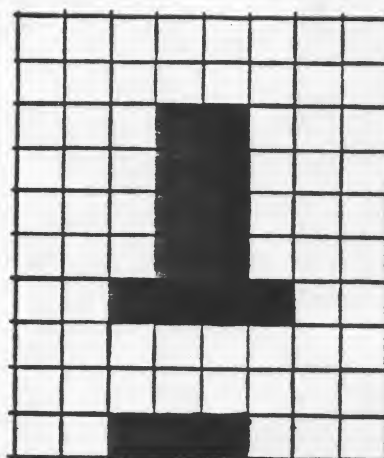
Figure 1

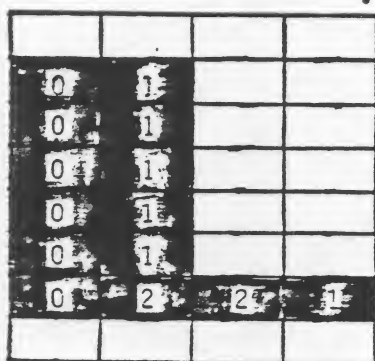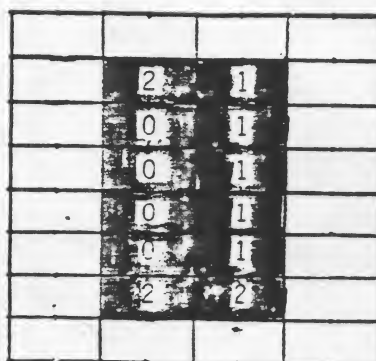(a)   (b)

Figure 2

(a)   (b)

Figure 3
The numbers in the shaded figures show the color register displayed.

```
0 REM ** LISTING 1
1 REM ** DEMO OF IR MODE 3
2 REM ** by Sheldon Leemon
3 REM **
5 REM ** SET UP MIXED-MODE SCREEN
6 REM **
10 ? CHR$(125):X=PEEK(560)+PEEK(561)*256+19:FOR I=0 TO 7:POKE X+I,3
20 NEXT I:POKE X+8,65:POKE X+9,PEEK(560):POKE X+10,PEEK(561)
21 REM *
25 REM * SET UP COMPARISON CHARACTERS
26 REM *
30 GOSUB 60:PRINT AT (2,16);" ";:GOSUB 60
40 PRINT AT (10,12);CHR$(6);CHR$(7)
41 PRINT AT (10,13);CHR$(7);CHR$(6);"  L1";CHR$(160)
45 PRINT AT (10,14);CHR$(6);CHR$(7);"     ";CHR$(160);"L1"
46 PRINT AT (10,15);CHR$(7);CHR$(6): PRINT AT (15,10);" "
50 POKE 752,1:PRINT AT (2,9);CHR$(28)
51 REM *
55 GOTO 55
56 REM *
60 FOR I=0 TO 127:? CHR$(27);CHR$(I);:NEXT I:RETURN


0 REM ** LISTING 2
1 REM ** DEMO IF IR MODES 4 AND 5
2 REM ** by Sheldon Leemon
3 REM **
5 REM ** SET UP MIXED-MODE SCREEN
6 REM **
10 ? CHR$(125):X=PEEK(560)+PEEK(561)*256+3:POKE X,69
15 FOR I=3 TO 8:POKE X+I,5:NEXT I:FOR I=9 TO 16:POKE X+I,4:NEXT I
20 POKE X+19,65:POKE X+20,PEEK(560):POKE X+21,PEEK(561):POKE 752,1:?
""
21 REM *
25 REM * PRINT CHARACTER SETS
26 REM *
30 PRINT AT (1,0);" ";:GOSUB 60:? :? :GOSUB 60
31 REM *
35 REM * CHANGE BACKGROUND COLOR
36 REM *
40 FOR DELAY=1 TO 1500:NEXT DELAY:? CHR$(253):SETCOLOR 8,0,14
41 REM *
45 REM * COLOR REGISTER CHANGE ROUTINE
46 REM *
50 R=0:S=5:GOSUB 70
52 S=PEEK(53279):IF S=5 THEN R=R+1+5*(R=4):GOSUB 70
54 IF S=6 THEN C=C+1+16*(C=15):SETCOLOR R+4,C,L:GOSUB 75
56 IF S=3 THEN L=L+2+16*(L=14):SETCOLOR R+4,C,L:GOSUB 80
58 FOR DELAY=1 TO 100:NEXT DELAY:GOTO 52
60 FOR I=1 TO 154:? CHR$(27);CHR$(I);:NEXT I
65 FOR I=156 TO 255:? CHR$(27);CHR$(I);:NEXT I:RETURN
70 M=PEEK(708+R):C=INT(M/16):L=M-16*C
```

SELECTED BIBLIOGRAPHY

The following magazine articles will aid the reader in understanding the subjects of character set editing and Player-Missile Graphics:

"Outpost:Atari--Missile Graphics Mysteries Revealed", George Blank, Creative Computing, January 1981, p.176

" Character Generation on the Atari", Charles Brannon, COMPUTE!, February 1981, p.76

" Player-Missile Graphics with the Atari PCS", Crawford, COMPUTE!, January 1981, pp. 66-77

" An Introduction to Atari Graphics", Crawford and Winner, BYTE, January 1981, pp.18-32

" Designing Your Own Atari Character Sets", Gary Patchett, COMPUTE!, March 1981, p.72

Besides the articles mentioned above, readers who have some technical background will want to consult the Atari Personal Computer System Hardware Manual, which is available from Atari Customer Service. This manual give complete details concerning hardware features. Appendices A and B, which deal with Player-Missile Graphics and mixing Graphics Modes, will be of particular interest.

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1. Name and APX number of program _____

2. If you have problems using the program, please describe them here.

_____

_____

_____

3. What do you especially like about this program?

_____

_____

_____

4. What do you think the program's weaknesses are?

_____

_____

_____

5. How can the catalog description be more accurate and/or comprehensive?

_____

_____

6. On a scale of 1 to 10, 1 being "poor" and 10 being "excellent", please rate the following aspects of this program:

_____ Easy to use
_____ User-oriented (e.g., menus, prompts, clear language)
_____ Enjoyable
_____ Self-instructive
_____ Useful (non-game software)
_____ Imaginative graphics and sound

7. Describe any technical errors you found in the user instructions (please give page numbers).

_____

_____

_____

8. What did you especially like about the user instructions?

_____

_____

_____

9. What revisions or additions would improve these instructions?

_____

_____

_____

10. On a scale of 1 to 10, 1 representing "poor" and 10 representing "excellent", how would you rate the user instructions and why?

_____

_____

11. Other comments about the software or user instructions:

_____

_____

_____

_____
                                                      | |
_____ |STAMP|
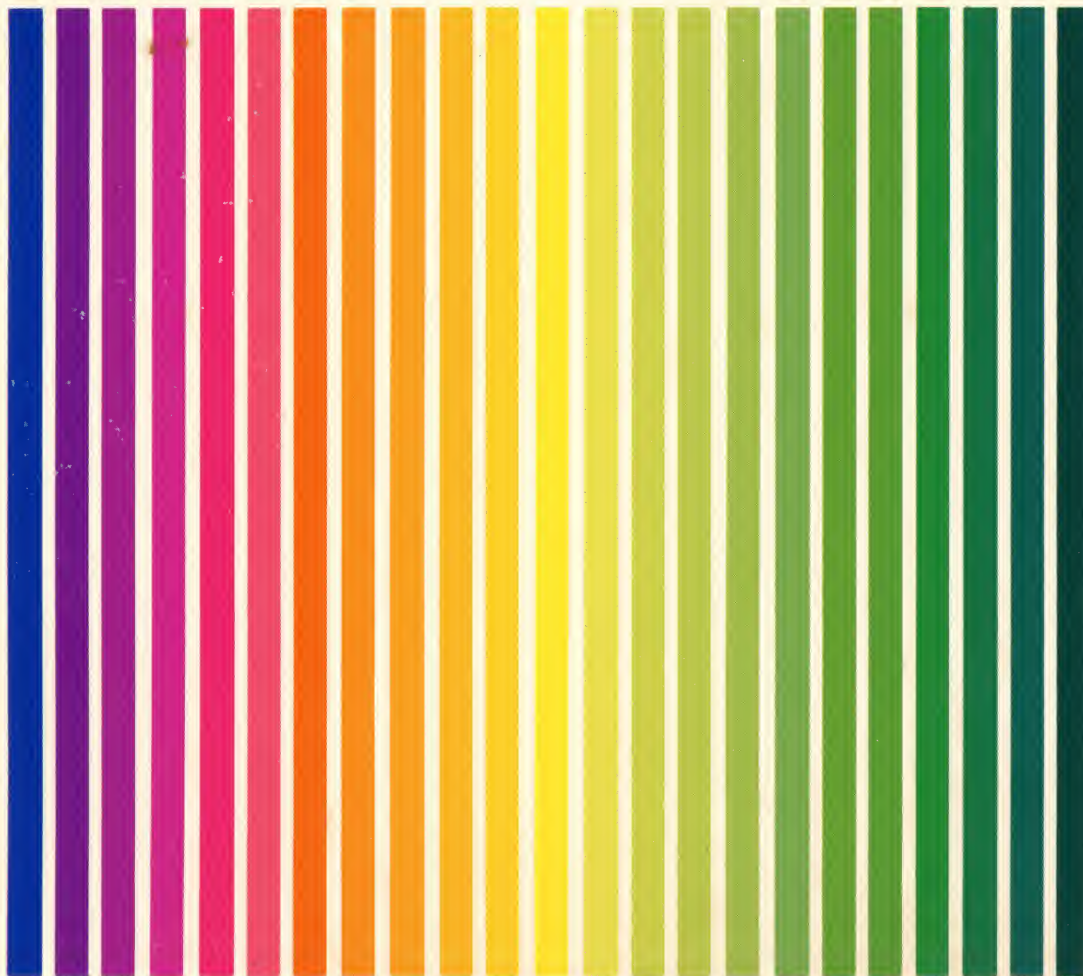 | |
_____

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CPX ATARI® PROGRAM EXCHANGE

Sheldon Leemon

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Microsoft BASIC version

APX-20113   March 1982

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